

## Numeric Answers to Problems Assigned This Semester

This list will be developed during the semester – come back often! Any questions? Email [ratcliff@usna.edu](mailto:ratcliff@usna.edu)

Note – At this stage of the game, my vector notation for this sheet is AWFUL! Speed of getting this info posted vs. accuracy! What a weak excuse.

### Chapter 2

- 3       $s=72\text{m}$ ,  $v=42\text{m/s}$ ,  $a=15\text{m/s}^2$   
10      $a=116.2\text{ft/s}^2 = 3.61\text{g}$   
14      $h=2040\text{m}$ ,  $t=40.8\text{s}$   
26      $a=1.168\text{ft/s}^2$ ,  $v=99.8\text{mi/hr}$   
32      $t=108.9\text{s} = 1.81\text{min}$   
37      $t=25.4\text{s}$   
48      $a=104.2\text{km/s}^2$   
55      $t_1=0.795\text{s}$ ,  $t_{10}=0.1592\text{s}$ ,  $t_{100}=0.1246\text{s}$   
63      $v_0=6.64\text{m/s}$ ,  $s=2.49\text{m}$   
79      $50.6^\circ$ , water lands  $2.5\text{ft}$  to right of B  
90      $53.1^\circ < \theta < 54.7^\circ$   
114     $v=20\text{m/s} = 72\text{km/hr}$   
117     $3.36\text{ rev/min}$   
129     $L=46.1\text{m}$   
137     $v = 4e\theta - 2.42e\theta \text{ m/s}$ ,  $a = 1.807e\theta - 7.99 e\theta \text{m/s}^2$   
145     $v=0.377\text{m/s}$ ,  $a=0.272\text{m/s}^2$   
150  
207     $0.4\text{m/s}$  (down)  
211     $400\text{mm}$   
222     $v_B/A = 0.5\text{m/s}$ ,  $a_B/A = 0.75\text{m/s}^2$ ,  $v_C = 1\text{m/s}$  (all to the right)  
186     $1442\text{km/hr}$ ,  $33.7^\circ$  west of south  
187     $(70.9\mathbf{i} - 46.9\mathbf{j}) \text{ km/hr}$ ,  $(1.5\mathbf{i} + 2.6\mathbf{j}) \text{ m/s}^2$   
190     $(10.22\mathbf{i} + 3.67\mathbf{j}) \text{ ft/s}^2$

### Chapter 3

- 7      a)  $6.44 \text{ ft/s}^2$ , b)  $16.10 \text{ ft/s}^2$   
17      $s = 64.3 \text{ m}$   
26      $a = 0.366\text{g}$   
31      $x = 201\text{m}$   
48      $T = 138.0\text{N}$ ,  $a = 0.766\text{m/s}^2$   
52      $N = 1.374\text{lb}$ ,  $\dot{v} = -16.10\text{ft/s}^2$   
54      $N = 0.024\text{lb}$   
76      $v = 149.4 \text{ ft/s}$  ( $101.8 \text{ mi/hr}$ ),  $v_{\text{MIN}} = 0$ ,  $v_{\text{MAX}} = 345\text{ft/s}$  ( $235 \text{ mi/hr}$ )  
79      $T = mLw^2$

- 105  $U_f = -672 \text{ ft-lb}$   
 119  $293 \text{ W}$   
 120  $v_B = 5.67 \text{ m/s}$   
 125  $89.2\%$   
 131  $v_C = 3.59 \text{ m/s}$   
 142  $v = 0.496 \text{ m/s}, x_{MAX} = 0.1864 \text{ m}, x_{SS} = 0.0932 \text{ m}$   
 148  $14.42 \text{ N}$   
 156  $v_B = 8.54 \text{ ft/s}$   
 158  $v_A = 0.616 \text{ m/s}, v_B = 0.924 \text{ m/s}$   
 165  $x_{MAX} = 0.1059 \text{ m}, v_{MAX} = 1.493 \text{ m/s}$   
 173  $v_B = 5.92 \text{ m/s}, 84.1 \text{ N}$   
 174  $v_B = 5.49 \text{ m/s}$   
 183  $v = 2.10 \text{ m/s}$   
 188  $F_{AV} = 59.5 \text{ N}$   
 206  $a = 150,000 \text{ ft/s}^2 (4660 \text{ g}), d = 0.075 \text{ ft (0.90 in)}$   
 208  $99.8\%$   
 221 a)  $H_o = 69.3 \text{ kg-m}^2/\text{s}$ , b)  $H_o = 69.3 \text{ kg-m}^2/\text{s}$   
 233  $\Delta T = 3mr^2 w_o^2/4, n = 3/4$   
 242  $T_B = 0.745 \text{ lb}$   
 218  $v_2 = 0.040 \text{ m/s}$   
 247  $v_1' = -4.52 \text{ m/s}, v_2' = 2.68 \text{ m/s}$   
 259  $R = 1.613 \text{ m}$   
 348  $v_{A2} = 4.20 \text{ m/s}, v_{A3} = 2.42 \text{ m/s}, v_{B3} = 5.36 \text{ m/s}, s = 2.28 \text{ m}$

## Chapter 4

- 32  $4.56 \text{ lb}$   
 47  $v = 56.4 \text{ m/s}; M = 29.8 \text{ kN-m}$

## Chapter 5

- 2  $v = 5 \text{ m/s}; \underline{a} = 50 \text{ m/s}^2; a = 50 \text{ m/s}^2;$   
 10  $\bar{v}_P = (-0.4\hat{i} + \hat{j}) \text{ m/s}; \bar{a}_P = (-1.4\hat{i} - 2.3\hat{j}) \text{ m/s}^2$   
 18  $OP = AB = 26.4 \text{ rad/s CCW}; BC = \text{zero}$   
 29  $66.7 \text{ s}$   
 33  $w = \frac{rhw_o}{x^2 + h^2}$   
 44  $OB = 0.572 \text{ rad/s CCW}$   
 55 a)  $0.909 \text{ m/s}^2$  up; b)  $0.918 \text{ m/s}^2$  down  
 60  $8.49 \text{ m/s}; 28.3 \text{ rad/s}$   
 65  $3.33 \text{ rad/s CW}$   
 80  $v_D = 9 \text{ m/s}$   
 85  $b = 35.8^\circ; w_2 = 1.923 \text{ rad/s}$   
 126  $v_o = -0.6\hat{i} \text{ m/s}; a_o = -1.8\hat{i} \text{ m/s}^2$

- 134  $\mathbf{a}_{OB} = \frac{v_A^2}{rL}$
- 142  $(\bar{a}_A)_t = 0; \mathbf{a}_{OA} = 0; (\bar{a}_D)_t = -480\hat{i} \text{ m/s}^2; \bar{a}_D = -120(4\hat{i} + 3\hat{j}) \text{ m/s}^2$
- 146  $a_G = -15.40\hat{i} \text{ m/s}^2$
- 149  $0.568 \text{ m/s}^2$
- 154  $\bar{v}_{REL} = -\Omega d\hat{j}$  and the result does not depend on the location of P
- 156  $\bar{v}_{REL} = (20\hat{i} - 9\hat{j}) \text{ m/s}$
- 168  $\alpha_{ODE} = 64.0 \text{ rad/s}^2$
- 174  $w = 5 \text{ rad/s CW}; \bar{a}_{REL} = -8.66\hat{i} \text{ m/s}^2$

## Appendix B

- 2  $I_{ZZ} = 2mL^2; I_{YY} = 4mL^2$
- 20  $R = 0.582$
- 30  $I_{XX} = mb^2/4$
- 40  $k_O = 0.0975 \text{ m}$

## Chapter 6

- 4 a)  $P = mgc/b$ ; b)  $P = mgc/b$
- 8  $F_A = 1.11 \text{ kN}; O_x = 45 \text{ N}; O_y = 667 \text{ N}$
- 15  $T_A = 12.99 \text{ lb}; T_B = 39.0 \text{ lb}$
- 27 a)  $\theta = 51.3^\circ$ ; b)  $\theta = 24.8^\circ$ ;  $a = 5g/4$
- 40  $T_1 = 116.2 \text{ N}; T_2 = 70.0 \text{ N}; \alpha = 0.622 \text{ rad/s}^2$
- 42  $b = 2.20 \text{ in}; R = 14.62 \text{ lb}$
- 48  $b = 40.7 \text{ mm}; R = 167.8 \text{ N}$
- 63  $\alpha = 20.8 \text{ rad/s}^2; R = 101.3 \text{ N}$
- 70  $\theta = 8.53^\circ$
- 76  $a = g/2 \text{ (constant)}$
- 79  $a_O = 7.02 \text{ m/s}^2; \alpha = 9.08 \text{ rad/s}^2$
- 83  $a = 0.425 \text{ m/s}^2; \alpha = -2.12 \text{ rad/s}^2; F = 19.38 \text{ N}$
- 91  $T = \frac{2\sqrt{3}}{13}mg \text{ independent of L}$
- 100  $a_A = 5.93 \text{ m/s}^2$
- 113  $v = 3.01 \text{ m/s}$
- 115  $v = 2.97 \text{ ft/s}$
- 119  $k = 1.270 \text{ kN/m}$
- 121  $h = 54.5 \text{ mm}$
- 124  $\omega = 3.31 \text{ rad/s}$
- 126  $v = \sqrt{6gbsin(q/2)}$
- 139  $v = 2.29 \text{ m/s}$
- 142  $v_{MAX} = 1.325 \text{ m/s}$

$$144 \quad \omega = 3.11 \text{ rad/s}$$

$$146 \quad v_A = \sqrt{3gL}$$

$$151 \quad w = \sqrt{\frac{6Pp}{13mb}}$$

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$$179 \quad \omega = 0.684 \text{ rad/s}$$

$$181 \quad \text{a) } H_O = 18 \text{ kg-m}^2/\text{s; b) } H_O = 16 \text{ kg-m}^2/\text{s c) } H_O = 14 \text{ kg-m}^2/\text{s}$$

$$195 \quad N = 4.78 \text{ rev/s}$$

$$200 \quad \omega = 109.6 \text{ rev/min; } \Delta E = 1.298 \text{ J}$$

$$202 \quad v' = \sqrt{\frac{9v^2}{4} \sin^2(\theta) + 3gL \cos(\theta)}$$